Amendments to the Specification

Please amend the paragraph beginning on line 7 of amended page 1 as follows:

The present invention generally relates to a heat sink ~~device~~ applied ~~for~~ to an integrated circuit, and more particularly to a package device with a heat sink ~~device~~ to reduce the thermal resistance and to improve the efficiency of thermal dissipation.

Please amend the paragraph beginning on line 15 of amended page 1 as follows:

In the electronics and computer industries, it has been well known to employ various types of electronic package devices and integrated circuit chips, such as the PENTIUM central processing unit chip (CPU) manufactured by Intel Corporation ~~and RAM (random access memory) chips~~. These integrated circuit chips have a pin grid array (PGA) package and are typically installed into a socket, which is soldered to a computer circuit board. These integrated circuit devices, ~~particularly to~~ for example, the CPU microprocessor chips, generate a great deal of heat during operation which must be removed to prevent ~~the~~ adverse effects ~~from operation of~~. [[the]] The PENTIUM microprocessor[[,]] contains[[ing]] million[[s]] of transistors, which ~~is~~ are highly susceptible to overheating which could destroy the microprocessor device itself or other components proximal to the microprocessor.

Please amend the paragraph beginning on line 3 of amended page 2 as follows:

In addition to the above ~~discussed~~ ~~microprocessors~~ discussion, there are many types of semiconductor package device, which are commonly used in computer equipment. For example, the resistors and thermistors generate large volumes of heat during normal operation and are also subject

to failure if the resistors and the thermistors cannot be cooled down properly.

Please amend the paragraph beginning on line 10 of amended page 2 as follows:

Also, the solid-state devices are commonly being installed onto a circuit board, which is, in turn, installed into a motherboard, or other similar primary circuit board. For example, microprocessors, such as the PENTIUM II and the Celeron from Intel, are "processor cards" which are installed into a motherboard of a computer in similar fashion to the way a modem is installed into a motherboard. Typically, on ~~On~~ a given processor card ~~is typically~~ are the processor semiconductor devices that are necessary for the ~~operation~~ operating of the card, such cache chips, or the like. The processor package may be installed into the processor card via a pin grid, ball grid, and land grid array and with a socket such as a ZIF or ball grid socket.

Please amend the paragraph beginning on line 23 of amended page 2 as follows:

~~In similar~~ Similarly, ~~fashion~~ according to the earlier semiconductor devices discussed above, there are many different types of electronic devices which suffer from overheating. For example, any electronic package device may have a threat of overheating. However, there are many types of electronic device that need cooling; however, the devices are too small to adequately support and receive the conventional metallic heat sink. These prior metallic heat sinks are commonly glued directly to the electronic device with a thermally conductive adhesive, or installed into the electronic package device with a mechanical structure, such as a spring clip. Further, the gap pads are [[often]] required to even out the interface surface to achieve thermal dissipating efficiency. In view of the foregoing issues related to these types of electronic components, providing heat ~~dissipation~~

dissipating in the form of heat sinks, and the like, ~~are~~ is difficult and the cost is prohibitive.

Please amend the paragraph beginning on line 10 of amended page 3 as follows:

FIG. 1 and FIG. 2 ~~showing~~ illustrate the conventional ball grid array package device 100 with heat slug. The ball grid array package device with heat slug includes a ball grid array substrate 102, a chip[[,]] or die 104 that is located on the ball grid array substrate 102, and a modified heat slug 106 that is positioned over the chip 104 and the ball grid array substrate 102. Then, a molding compound 108 is injected into the ball grid array package device 100 to perform the ball grid array package device manufacturing. Referring to FIG. 2, the die or chip 104 is covered [[below]] by the molding compound 108, and the thermal conductivity of the molding compound 108 is too low to cause the heat dissipating efficiency ~~that is~~ would be limited by the heat dissipating path. The solution method is that [[added]] an embedded heat slug 108 is added onto the die or chip 104 to increase the heat dissipating area. Nevertheless, the defect of this technique is that the ~~large volume of heat, which is generated by the~~ die or chip 104 would generate a large volume of heat that cannot be removed to the environment to reduce the operating temperature of the die or chip 104. Therefore, the chip or die 104 cannot be operated.

Please amend the paragraph beginning on line 18 of amended page 4 as follows:

It is an object of this invention is to provide a ~~heat sink body~~ package device with a heat ~~dissipating~~ sink assembly ~~members~~ thereon, wherein the heat sink [[body]] assembly is ~~formed~~ made by casting to increase the heat ~~dissipation~~ [[effect]] dissipating efficiency.

Please amend the paragraph beginning on line 23 of amended page 4 as follows:

It is another object of this invention is to provide a ~~conductive protruding~~ thermal block on the backside of the first heat sink [[body]] assembly to associate the cavity of the ball grid array package device with modified embedded heat slug to improve the heat dissipating efficiency.

Please amend the paragraph beginning on line 3 of amended page 5 as follows:

It is a further object of this invention is to provide at least two ~~conductive~~ thermal supports on the backsides of first heat sink [[body]] assembly to join the ~~through holes~~ openings of the ~~bottom plate~~ second heat sink assembly.

Please amend the paragraph beginning on line 6 of amended page 5 as follows:

It is yet object of this invention is to provide a ~~bottom plate~~ second heat sink assembly to join at least two ~~conductive~~ thermal supports of the first [[the]] heat sink assembly ~~with the at least two conductive supports~~ to ~~contact with~~ attach the backside of the printed circuit board to ~~introduce~~ dissipate the heat ~~which is generated by the die or chip. The heat can be removed~~ from the backside of the printed circuit board through the ~~bottom plate~~ second heat sink assembly to [[the]] at least two ~~conductive~~ thermal supports of the first heat sink assembly ~~to the heat dissipating structure~~.

Please amend the paragraph beginning on line 14 of amended page 5 as follows:

According to abovementioned objects, the present invention provides the heat sink device for the ball grid array package device with a modified embedded heat slug to improve the heat dissipating efficiency. The heat sink device is constructed of first heat sink assembly and the second

heat sink assembly. The first heat sink assembly includes ~~a heat dissipation that located above the heat sink body, and~~ at least two ~~conductive~~ thermal supports that located [[below]] under the two sides of the first heat sink [[body]] assembly, which is used to increase the heat dissipating area. A ~~conductive protruding~~ thermal block located below the backside of the heat sink [[body]], and the ~~conductive protruding~~ thermal block associated with the cavity of the ball grid array package device with modified embedded heat slug to increase the heat dissipating efficiency. In addition, the second [[the]] heat sink assembly is a bottom plate, which includes [[the]] a protruding structure in the ~~central~~ center of the ~~bottom plate~~ second heat sink assembly, and at least two ~~through holes~~ openings on the two sides of the ~~bottom plate~~ second heat sink assembly respectively. The protruding structure ~~contacted with~~ attached to the backside of the printed circuit board to increase the efficiency of heat dissipating and to remove the heat that is generated from the die or chip. [[,]] ~~therefore, the heat is generated die or chip that can be removed by the dissipation~~, In addition, ~~and to join the~~ at least two openings of the second heat sink assembly joined at least two ~~conductive~~ thermal supports of the first heat sink [[body]] assembly to fix the first heat sink assembly, the second heat sink assembly, and the ball grid array package device, in which the ball grid array package device positioned ~~on the printed circuit board that~~ between the first heat sink assembly and second heat sink assembly.

Please amend the paragraph beginning on line 22 of amended page 6 as follows:

FIG. 1 is a schematic ~~representation~~ that shows the lateral view of device of the ball grid array package device with the modified embedded heat slug in accordance with the prior conventional technique;

Please amend the paragraph beginning on line 5 of amended page 7 as follows:

FIG. 3 is a schematic that shows the cross-sectional view of the structure of a first heat sink assembly that includes ~~a heat sink body,~~ a first heat sink structure ~~dissipation~~ thereon, at least two ~~conductive~~ thermal supports located [[below]] under two sides of the heat sink body, and a ~~conductive protruding~~ thermal block that located [[below]] on the backside of the first heat sink structure [[body]] in accordance with the device disclosed herein;

Please amend the paragraph beginning on line 14 of amended page 7 as follows:

FIG.4 is a schematic that shows the cross-sectional view of the thermal conductive adhesive tape spread overall the surface of backside of the first heat sink [[body]] structure to fix and to increase the heat dissipating efficiency in accordance with the device disclosed herein;

Please amend the paragraph beginning on line 16 of amended page 7 as follows:

FIG.5 is a schematic that shows the cross-sectional view of the structure of the ball grid array package device with modified embedded heat slug on the printed circuit board in accordance with the device disclosed herein;

Please amend the paragraph beginning on line 1 of amended page 8 as follows:

FIG. 6 is a schematic that shows the cross-sectional view of the structure of the second heat sink assembly in accordance with the device disclosed herein;

Please amend the paragraph beginning on line 6 of amended page 8 as follows:

FIG. 7 is a schematic that shows the cross-sectional view of the ~~conductive~~ thermal support of the heat sink body passed through the at least two through holes of the printed circuit board to fix the printed circuit board in accordance with the device disclosed herein; and

Please amend the paragraph beginning on line 11 of amended page 8 as follows:

FIG. 8 is a schematic that shows the heat dissipating is introduced from the printed circuit board to the heat sink assembly in accordance with the structure disclosed herein.

Please amend the paragraph beginning on line 24 of amended page 8 as follows:

The present invention provides the package device with modified embedded heat slug to reduce the thermal resistance and to increase the heat dissipating capability. The package device can be a ball grid array package device. FIG. 3 through FIG. 7 ~~showing~~ illustrates the structure, function, and the relationship there-between of the heat sink device, and FIG. 8 represents the heat-dissipating path according to the heat sink device as provided in the present invention. FIG. 3 represents the structure of the first [[the]] heat sink assembly 1A, which includes a first heat dissipating structure 2 and a second heat dissipating structure 4. The second heat dissipating structure 4, such as a heat dissipating fin located on the first heat dissipating structure 2. The second heat dissipating structure 4 used [[for]] to ~~increasing~~ increase the heat dissipating area to improve the heat dissipating efficiency. At least two ~~conductive~~ thermal supports 6 located on the backside of the first heat dissipating structure 2 that is ~~connected with~~ attached to the package device with modified embedded heat slug on the printed circuit board (as shown in FIG. 5), and is connected with the second the heat sink assembly (as shown in FIG. 4).

Please amend the paragraph beginning on line 17 of amended page 9 as follows:

The key feature of the present invention is that the first heat dissipating structure 2 is made of conductive material such as metal, and is [[formed]] made by casting, therefore, the heat dissipating efficiency would be improved. Another key feature of the present invention is that at least two ~~conductive~~ thermal supports 6 located on the backside of the first heat dissipating structure 2 that replaced the conventional plastic supports on the backside of the first heat dissipating structure 2 to increase the heat dissipating efficiency.

Please amend the paragraph beginning on line 3 of amended page 10 as follows:

As referring to FIG. 3, the first heat-dissipating structure 2 further includes a ~~conductive protruding~~ thermal block 8 on the backside of first heat dissipating structure 2. The ~~conductive protruding~~ thermal block 8 contacts with the cavity 24 of the package device with modified embedded heat slug to increase the heat dissipating efficiency, when the large number of heat is generated during ~~operating~~ the operation of the integrated circuit. In alternative preferred embodiment, the thermal conductive adhesive tape 10 is spread overall the surface of backside of the first heat dissipating structure 2 (as shown in FIG. 4) that ~~is used to~~ contacted with the surface of the molding compound 26 of the package device and to introduce the heat conductivity to increase the heat dissipation efficiency.

Please amend the paragraph beginning on line 15 of amended page 10 as follows:

FIG. 4 shows another alternative embodiment of the present invention. The thermal conductive

adhesive tape 10 located on the backside of the first heat dissipating structure 2[[,]]~~wherein~~ in which the thermal conductive adhesive tape 10 is spread around the backside of the first heat dissipating structure 2, besides the ~~conductive~~ ~~protruding~~ thermal block 8. The key feature of the present invention is that the ~~conductive~~ ~~protruding~~ thermal block 8 is [[an]] unitary member with the first heat dissipating structure 2, and located on the backside of the first heat dissipating structure 2, or added on the backside of the first heat[[-]]dissipating structure 2.

Please amend the paragraph beginning on line 3 of amended page 11 as follows:

FIG. 5 represents the structure of the package device with modified embedded heat slug on the printed circuit board. The structure includes a ball grid array package substrate 20, a modified embedded heat slug 22 that located on the ball grid array package substrate 20, and the modified embedded heat slug 22 having a cavity 24 therein, which is used to reduce the thickness of the molding compound 26 when the molding compound is mold into the ball grid array package device. In addition, the plurality of balls 28 located below the ball grid array package substrate 20 to connect with the printed circuit board 12. Furthermore, the printed circuit board 12 includes at least two holes 14 ~~thereon~~ therein to pass through the at least two ~~conductive~~ thermal supports 6.

Please amend the paragraph beginning on line 18 of amended page 11 as follows:

In another embodiment, when the printed circuit board 12 ~~without~~ did not have two holes 14 therein to provide the ~~conductive~~ thermal support 6 to pass through, the ~~conductive~~ ~~protruding~~ thermal block 8 can assemble with the cavity 24 of the heat slug ~~without holes 14 within the printed circuit board 12~~. Also, the conductive material can be an adhesive material to adhere the first heat

dissipating structure 2 and the ball grid array package device 22.

Please amend the paragraph beginning on line 23 of amended page 11 as follows:

FIG. 6 represents the structure of the second heat sink assembly 1B. The second heat sink assembly 1B is a bottom plate, which has at least two ~~through holes~~ openings 34 on the two sides and a protruding structure 32 of the ~~central~~ center of the bottom plate 1B. At least two ~~through holes~~ openings 34 ~~used to~~ joined at least two ~~conductive~~ thermal supports 6, and the first heat sink assembly 1A that is fixed with the second heat sink assembly 1B by the groove 7 on the side of the at least two ~~conductive~~ thermal supports 6 and the blot 36 of the ~~through holes~~ two openings 34.

Please amend the paragraph beginning on line 9 of amended page 12 as follows:

Furthermore, the protruding structure of the ~~central~~ center 32 of the bottom plate 1B can ~~contact with~~ attach to the backside of the printed circuit board 12, therefore, the heat can be removed from the bottom plate 1B through at least two ~~conductive~~ thermal supports 6, and the second heat dissipating structure 4 to the outside. The advantage of the abovementioned description is that the dissipating space of backside of the printed circuit board 12 can be increased to improve the heat dissipating efficiency. Moreover, the second heat sink ~~assembly~~ structure 4 can use for the conventional BGA (ball grid array) package device or TEBGA (thermal enhanced ball grid array) package device without using ~~conductive protruding~~ thermal block 8.

Please amend the paragraph beginning on line 20 of amended page 12 as follows:

FIG. 7 represents the ~~conductive~~ thermal supports 6 of the first heat dissipating structure 2 that

passed through the holes 14 of the printed circuit board 12 to the backside of printed circuit board 12 to first heat dissipating structure 2. According to the view of the mechanical design, at least two ~~conductive~~ thermal supports 6 [[does]] do not contact with the hole-wall of the holes 14, because there is a tolerance between at least two ~~conductive~~ thermal supports 6 and the hole-wall of the hole 14. Nevertheless, the objective of the present invention is to improve the heat dissipating efficiency, thus, after the grounded plane 12A is passed through by the ~~conductive~~ thermal supports 6, and the conductive material 42 is filled with the gap space between the hole-wall of holes 14 and at least two ~~conductive~~ thermal supports 6.

Please amend the paragraph beginning on line 10 of amended page 13 as follows:

Therefore, the heat can be removed from the grounded plane 12A of the printed circuit board 12 to at lest two ~~conductive~~ thermal supports 6, and transferred to the first heat dissipating structure 2. On the other hand, the heat also can be removed from the ball grid array package device through the heat slug 22 of the ball grid array package device to the second heat sink assembly 1B to at least two ~~conductive~~ thermal supports 6, and to the grounded plane 12A of the printed circuit board 12. Moreover, the heat sink assembly also can be used only with at least two ~~conductive~~ thermal supports 6, and at least two springs, but without the bottom plate 1B.

Please amend the paragraph beginning on line 20 of amended page 13 as follows:

The key feature of the embodiment, the bottom plate 1B is made of the conductive material or metal, therefore, the bottom plate 1B can increase the heat dissipating efficiency for ~~overall heat sink device~~ the package device. Furthermore, the second heat sink assembly 1B further includes at least

two springs 40 that put around at least two ~~conductive~~ thermal supports 6 to pull tight between the first heat sink assembly 1A and the second heat sink assembly 1B.

Please amend the paragraph beginning on line 4 of amended page 14 as follows:

FIG. 8 represents the cross-sectional of the construction of the package device with heat sink device 1. The heat would be generated from the chip or die ~~during~~ when the computer is operated, thus the heat should be removed to reduce the operating temperature to keep the computer operating stabil[[it]]y. The heat can be removed by the first path. The first path is that the heat is removed by introducing the heat to the heat slug 22 of package device to the ~~conductive protruding~~ thermal block 8, first heat dissipating structure 2, and second heat dissipating structure 4. On the other hand, the second path is that the heat also can be removed from the backside of the printed circuit board 12 that passed through [[up]] to the ~~conductive~~ thermal supports 6 to the first heat sink assembly 1A, or passed through down to [[the]] at least two springs 40 to at least two ~~through holes~~ openings 32 of [[the]] two sides of the bottom plate 1B to the printed circuit board grounded layer 12A, or the heat also can be removed from the backside of the printed circuit board 12 through the protruding structure 32 of the bottom plate 1B to the printed circuit board grounded layer 12A.

Please replace the originally filed abstract with the following amended abstract:

The present invention provides the heat sink device for the package device to improve the heat dissipating efficiency. The heat sink device includes a first heat sink assembly that includes a heat dissipating structure ~~that located above the heat sink body and used~~ to increase the heat dissipating area. At least two ~~conductive~~ thermal supports located on the backsides of the first

heat sink [[body]] assembly, which used to fix the heat sink assembly with printed circuit board and also conduct the heat from thermal source to heat dissipating structure. A ~~conductive protruding~~ thermal block located on the backside of the first heat sink [[body]] assembly, wherein the ~~conductive protruding~~ thermal block used to associate with the cavity of the package device to increase the heat dissipating efficiency. In addition, the center structure of the second [[the]] heat sink assembly ~~includes a bottom plate to contact with~~ attached to the backside of the printed circuit board to increase the heat dissipating efficiency to remove the heat that is generated from the die or chip that located on the printed circuit board~~, and to join at least two conductive supports of the heat sink body to fix the heat sink assembly on the printed circuit board~~.